

1. Let  $x(t) = e^{-t/\tau}u(t)$ . Find the percentage of energy contained in the frequencies  $|f| < W$  when  $W = 1/2\pi\tau$  and  $W = 2/\pi\tau$ .
2. Find the Fourier series of a triangle wave.
3. Let  $x(t) = A \sin(2\pi t/\tau)\Pi(t/\tau)$ .
  - (a) Find  $X(f)$ .
  - (b) Sketch  $|X(f)|$ .
4. Find the autocorrelation of  $\text{sinc}(t)$ .
5. Find the Hilbert transform of  $\text{sinc}(t)$ .
6. Consider an AM transmitter rated for 4 kW PEP. Find the maximum modulation index  $\mu$  if the message signal is sinusoidal and the average transmitted power is  $P_T = 1$  kW.  $P_T = P_{\text{carrier}} + 2P_{\text{signal}}$  for DSB AM.
7. Describe the envelope of an 8-PSK signal.
8. Suppose a superhet has  $f_{IF} = 455\text{kHz}$  and  $f_{LO} = 1/(2\pi\sqrt{LC})$ , with fixed  $L = 1\mu\text{H}$  and variable  $C$ .  $540 < f_c < 1600\text{kHz}$ . Find the range of  $C$  when  $f_{LO} = f_c + f_{IF}$  and  $f_{LO} = f_c - f_{IF}$ .